

Monitoring Physical and Chemical Processes Influencing Reef Health

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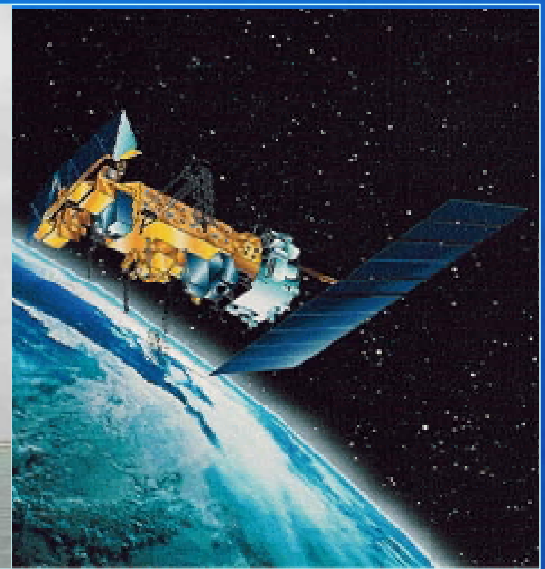
NOAA Coral Reef Watch, Silver Spring, MD

NOAA Atlantic Oceanographic and Meteorological Laboratory, Miami, FL



Physical Monitoring Components






-  Ship-based spatial oceanographic and water quality surveys
-  *In situ* instrumentation
-  Satellite observations
-  Modeling: Hydrodynamic and Ecological





Key Threats Addressed




Climate Change

-  Ocean Warming
-  Ocean Acidification
-  Sea-level Rise
-  Changing Ocean Circulation,
-  Storm Tracks and Intensities




Impacts of Fishing

-  Biological Productivity
-  Larval Transport/Recruitment
-  Vessel Surveillance/Detection

Land-based Sources of Pollution

-  Eutrophication
-  Nearshore hydrologic cycles
-  Nearshore hydrodynamic processes

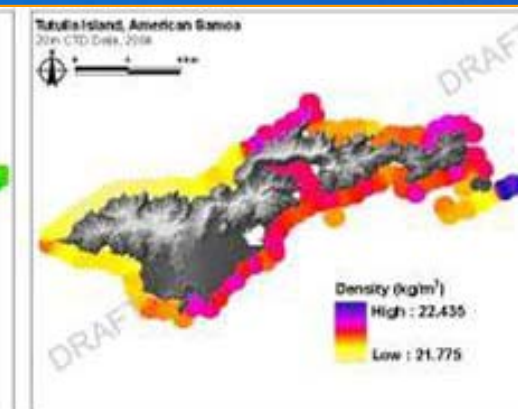
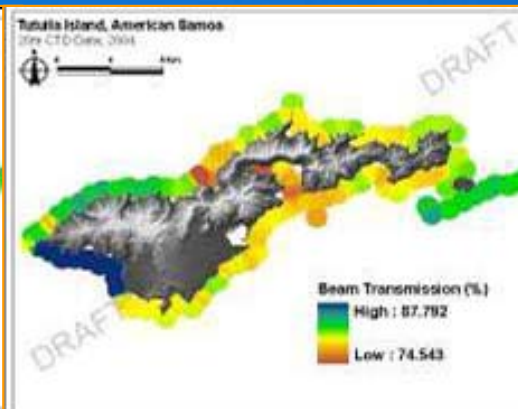
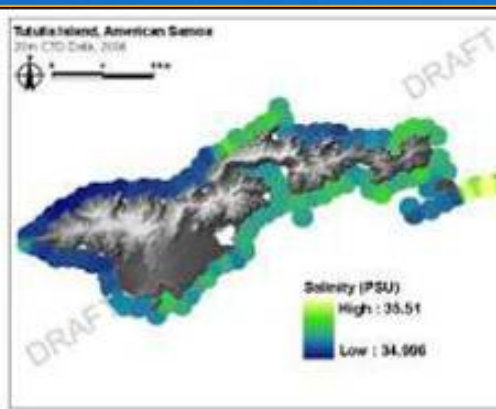
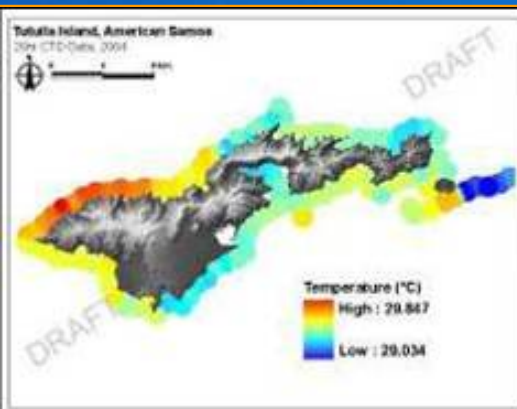
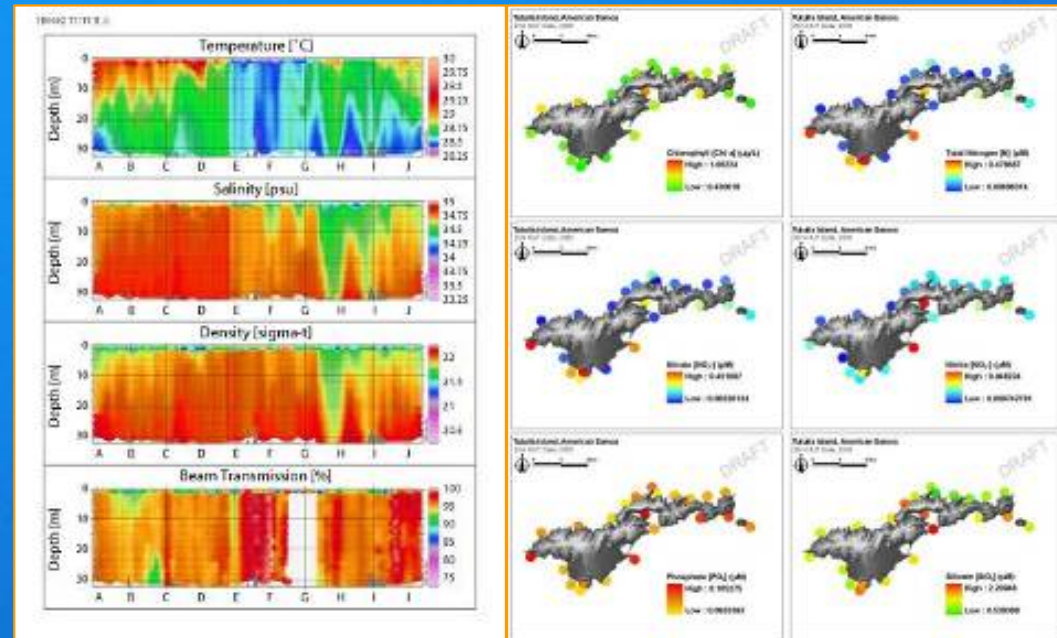
Alien/Invasive Species

-  Coral Disease
-  Recreational Overuse
-  Marine Debris

Capability 1: Ship-based Monitoring

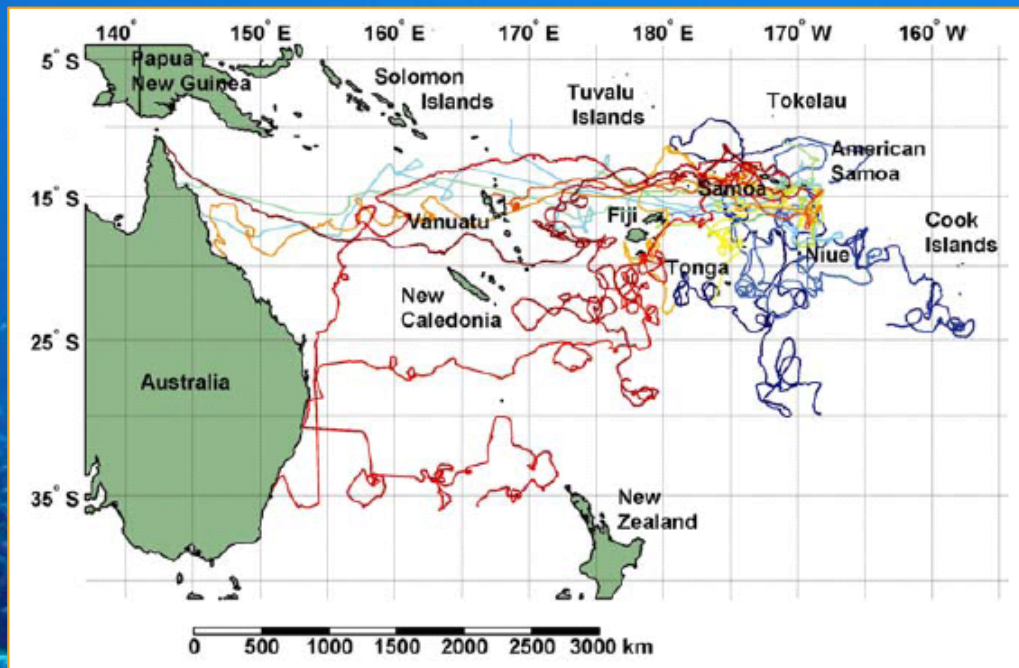
Spatial Structure of:

- Temperature
- Salinity
- Chlorophyll
- Turbidity
- Nutrients
- Carbon chemistry
- Current Velocity

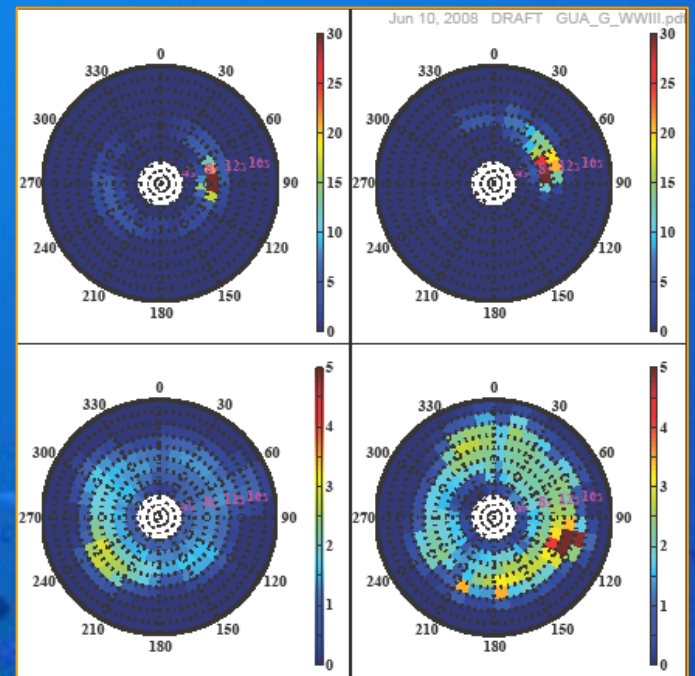


Capability 1: Ship-Based Monitoring

- Management Requests for Ship-based Data:
 - Currents for larval dispersal (All jurisdictions)
 - Currents and waves for LBSP (Guam, CNMI, AS)



Larval drift around American Samoa



Waves in the Marianas



Capability 2: *In situ* Instrumentation

Near Real-time Instrumentation (24)

 CRED/CREWS & SST Buoys

 ICON/CREWS Pylons (proposed)

Subsurface Instrumentation (229)

 Wave & Tide Recorders (WTR)

 Ocean Data Platforms (ADCP)

 Current Meters (CM)

 Subsurface Temperature Recorders

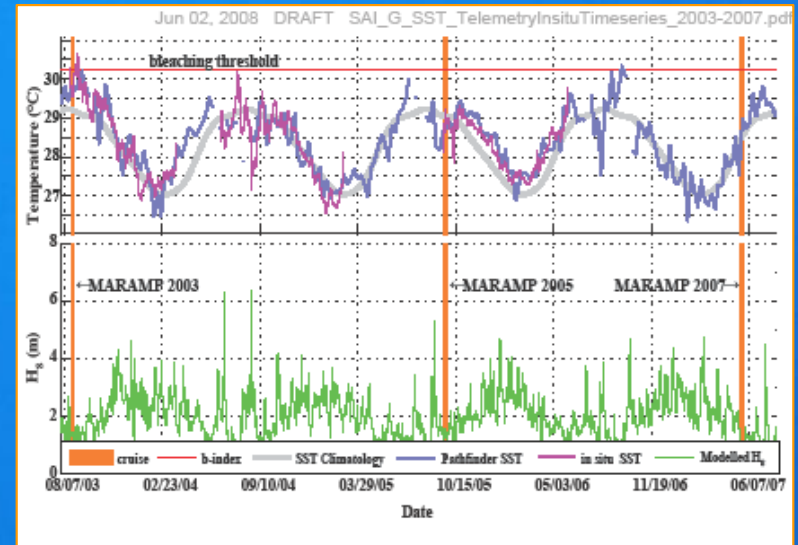
 Ecological Acoustic Recorders (EARs)



Capability 2: *In situ* Instrumentation

Parameters measured:

- Temperature (sfc and bottom)
- Air Temperature, Pressure, and Wind
- Salinity
- Currents (profiles)
- Waves
- Light (PAR, UV, Fluorescence)
- pCO₂, Alkalinity, pH
- Sound (biological, physical, and anthropogenic)
- Nutrients





Capability 2: *In situ* Instrumentation

Management Requests for *In Situ* Monitoring:

Water quality (CNMI, Guam) - **CREWS/ICON**

Currents for larval transport and connectivity (AS, Guam, CNMI) - **Drifters/ODP/CM**

Currents and waves for LBSP (CNMI, Guam, AS) - **WTR/ODP for Model Input/Validation**

Ecological modeling (Guam) - **Model input/validation**

Biological indicators for alien species (HI) - **ARMS**

Ocean acidification (HI) - **MAPCO₂**

Vessel detection/poaching (All) - **EARs**

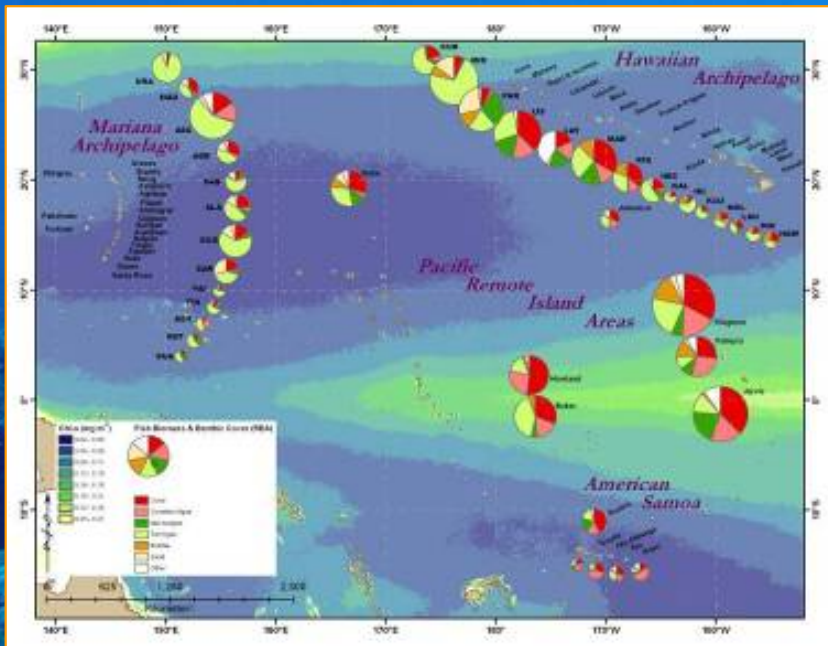
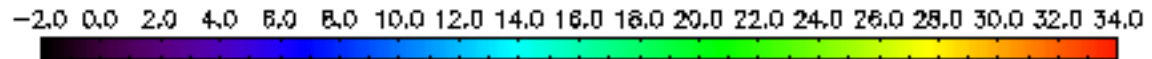
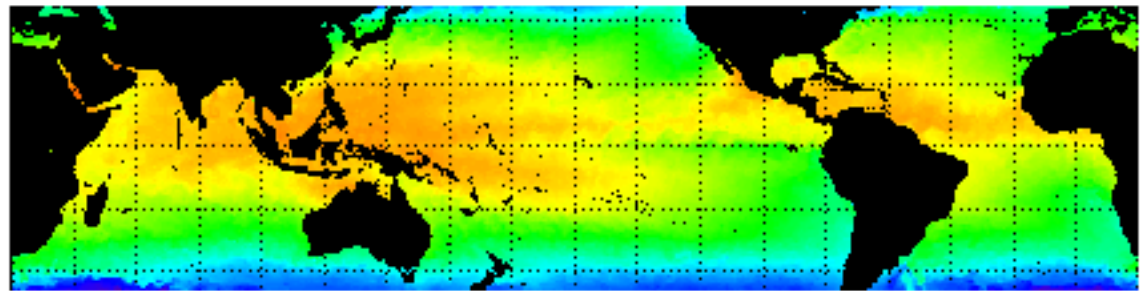
Satellite and Model Initiation/Validation



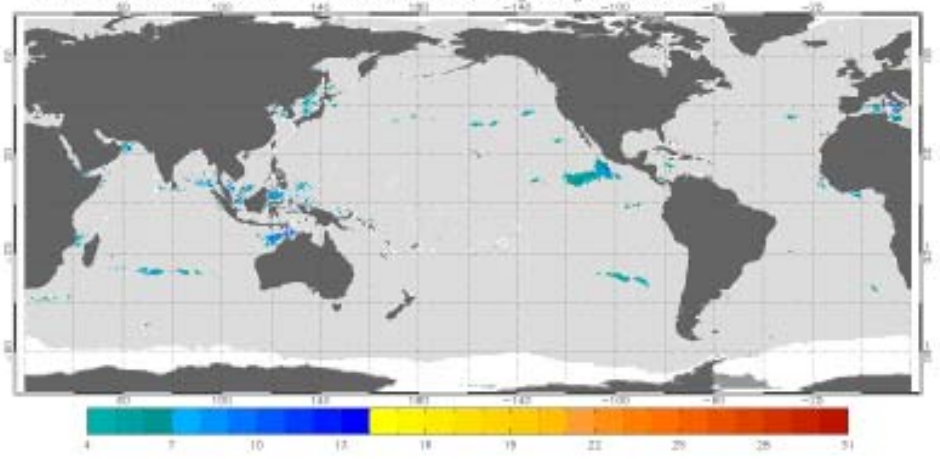
Capability 3: Satellite Monitoring

- NOAA SST
- NOAA Wind
- NOAA Ocean Productivity
- NOAA Sea Surface Height

NOAA/NESDIS 50 km Nighttime SST (C), 10/30/2008



NOAA/NESDIS Doldrums (days) v0.2 for 18 Oct 2008
EXPERIMENTAL PRODUCT QuikSCAT 0.25-degree gridded winds





Capability 3: Satellite Monitoring



Global SST Products:



Coral bleaching nowcasts



Satellite Bleaching Alerts



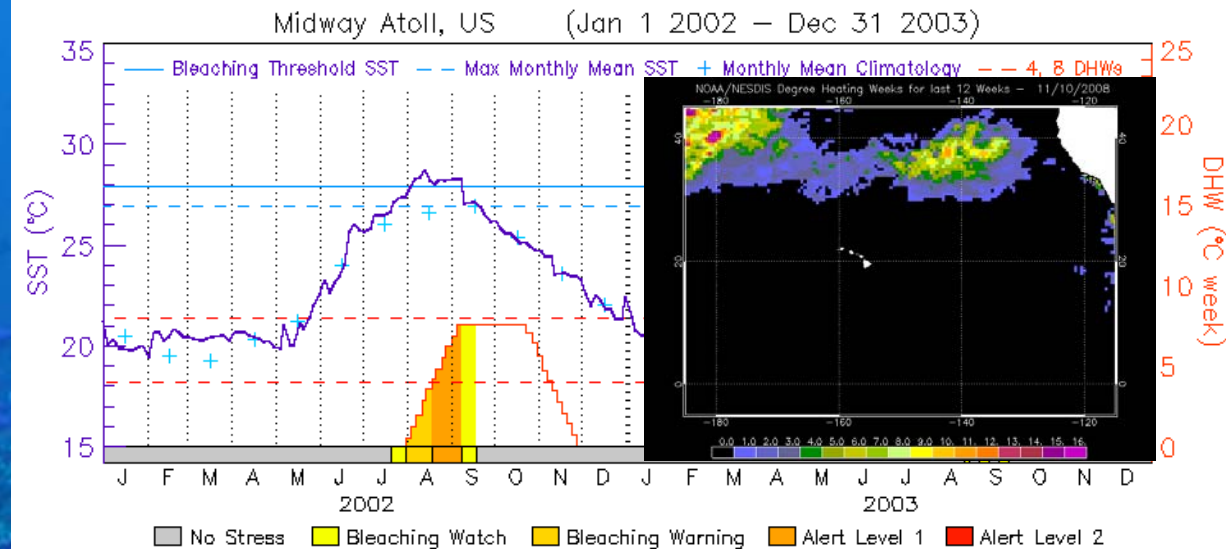
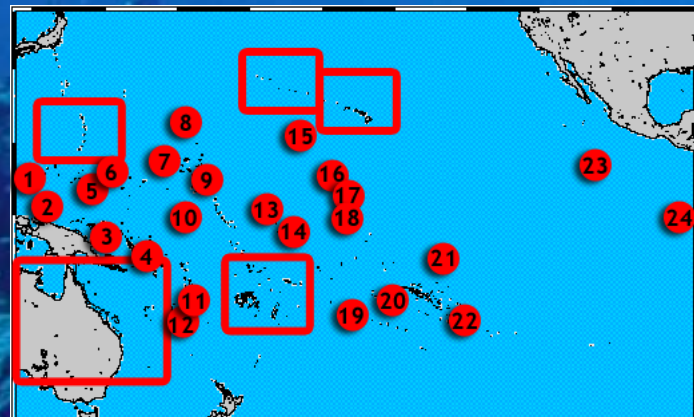
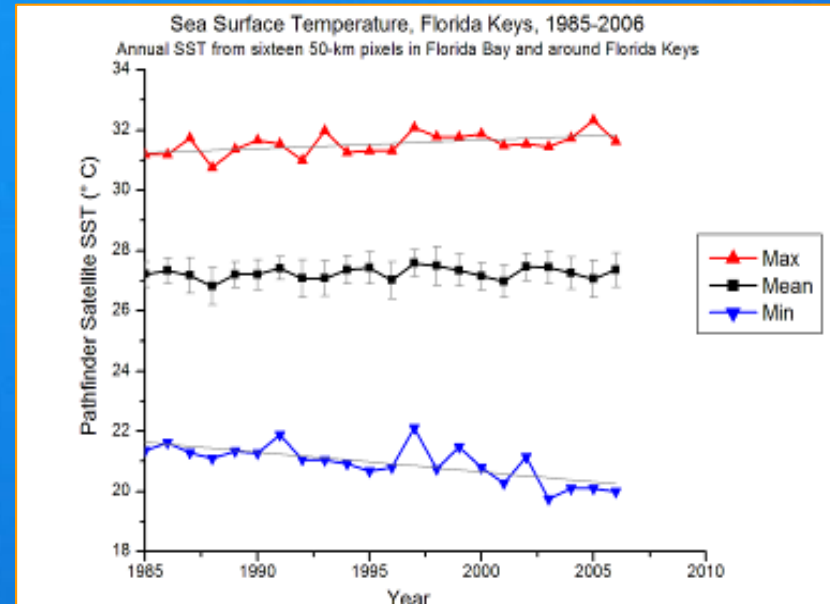
Virtual Stations



Near-real-time data









Long-term data





Capability 3: Satellite Monitoring

-  Management Requests for Remotely-Sensed Data:
 -  Water quality (CNMI, HI)
 -  Land use changes (CNMI, Guam, AS)
 -  Bleaching event prediction (AS, Guam) - **CRW**
 -  Sea level rise (CNMI, Guam, HI) - **NOAA/UH**
 -  Ocean acidification (HI) - **CRW**



Capability 4: Modeling

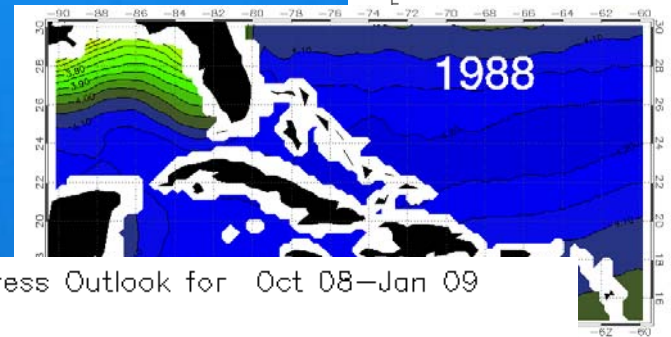
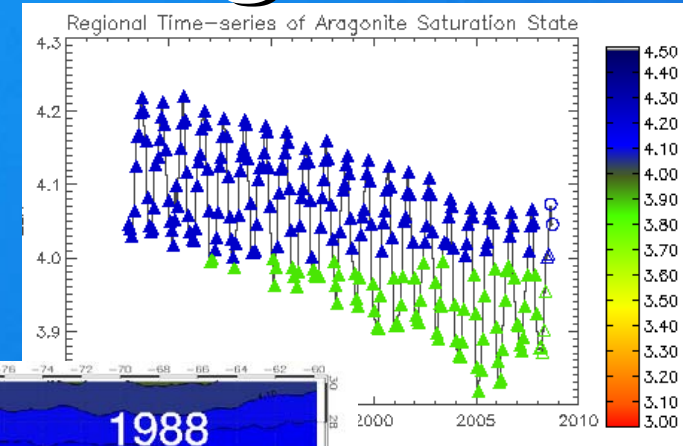
Modeling Products:

Bleaching forecasts

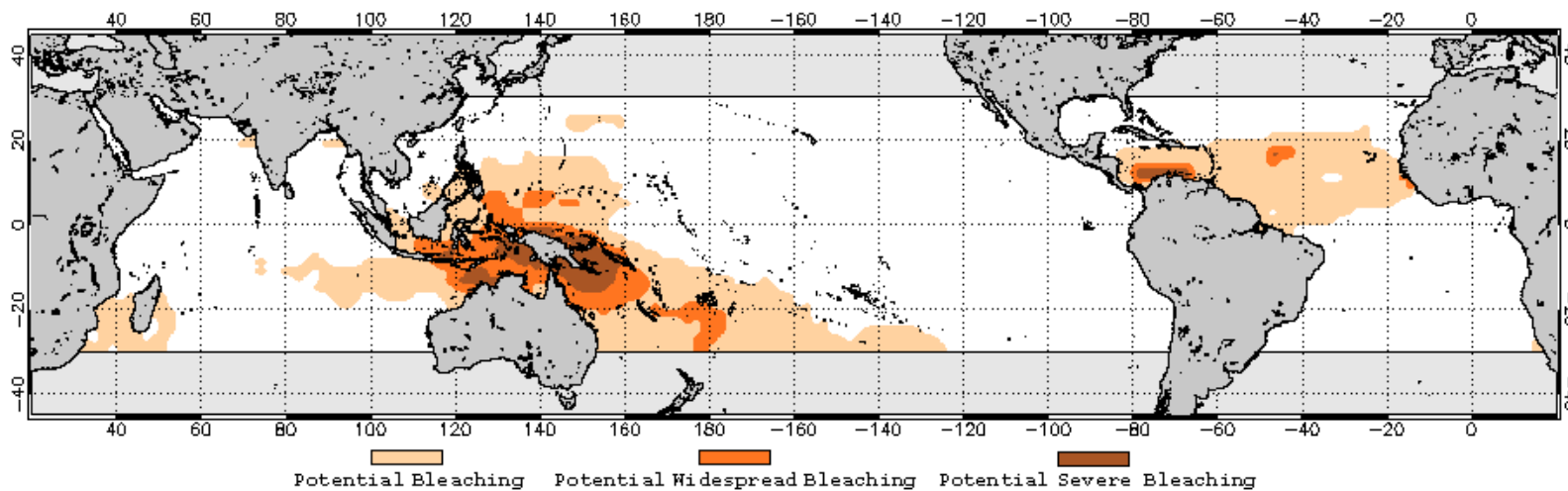
Ocean acidification

Nearshore currents

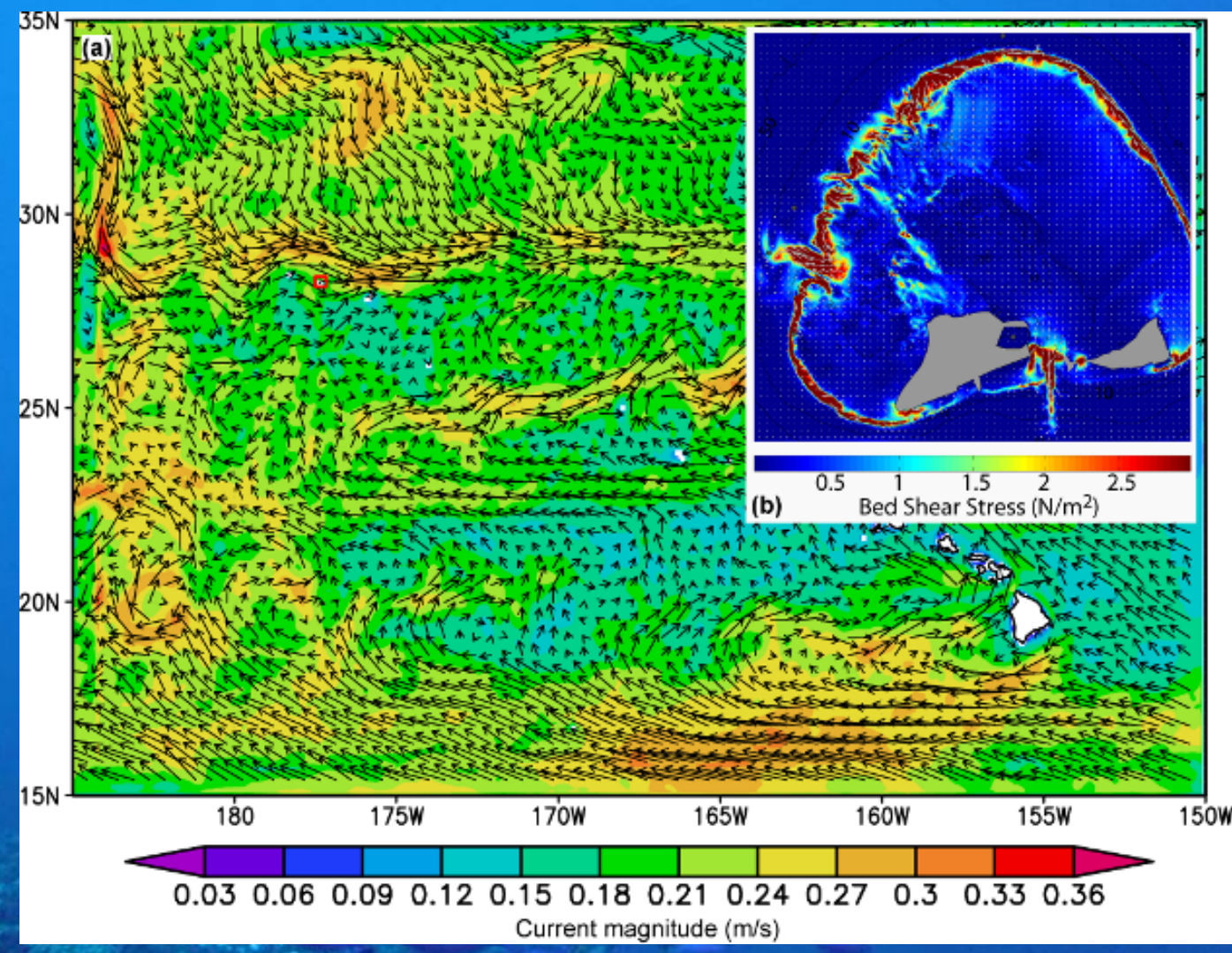
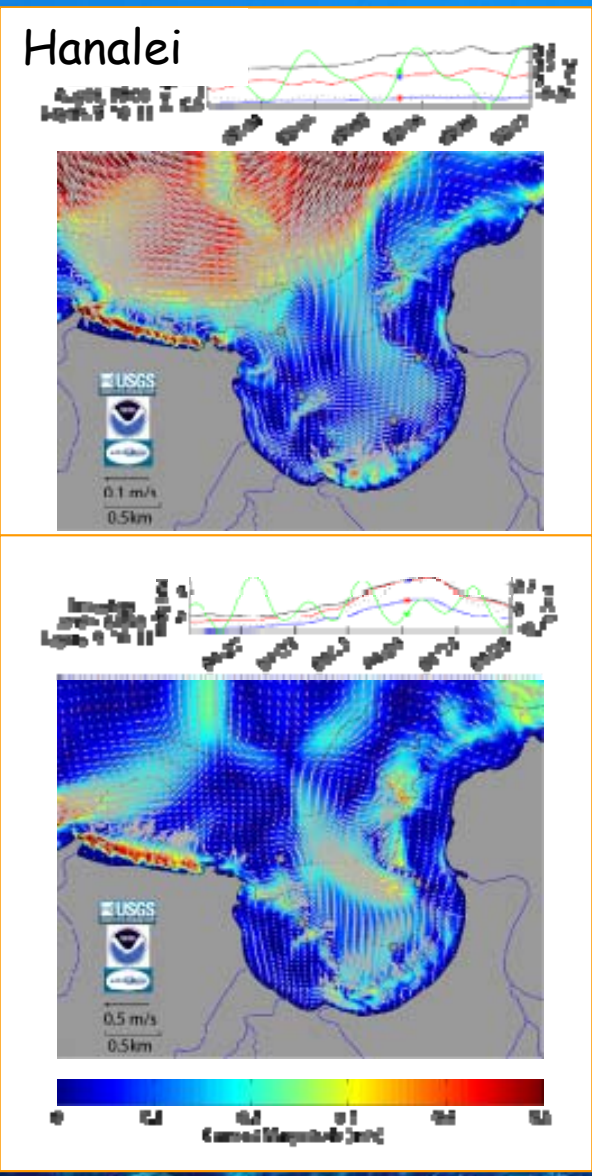
Larval transport



2008 Oct 28 NOAA Coral Reef Watch Coral Bleaching Thermal Stress Outlook for Oct 08-Jan 09








Hydrodynamic Modeling



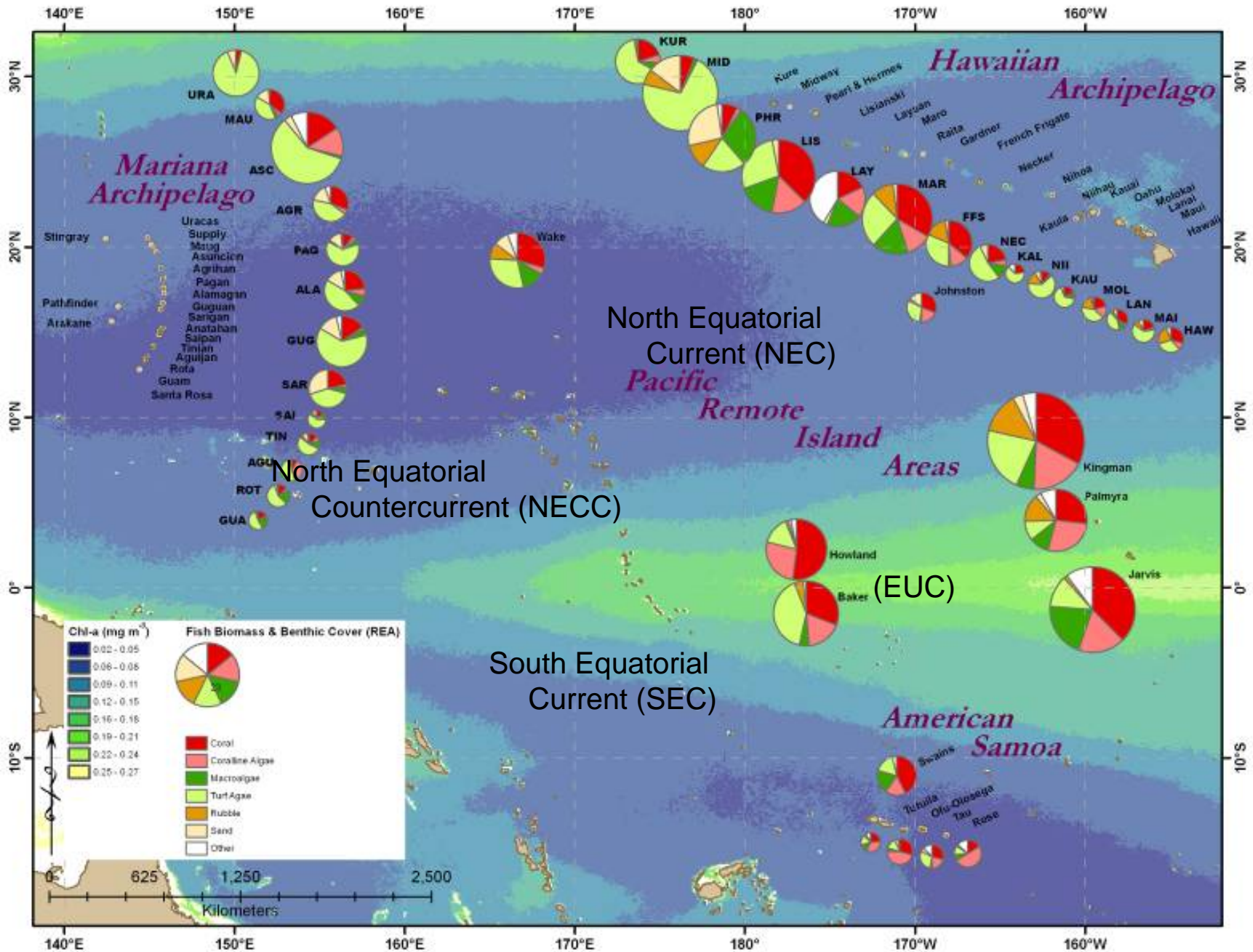


Capability # 4: Modeling

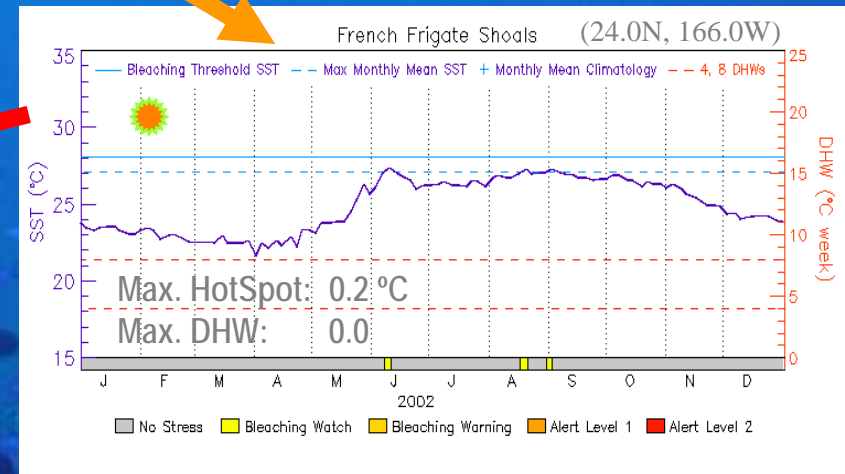
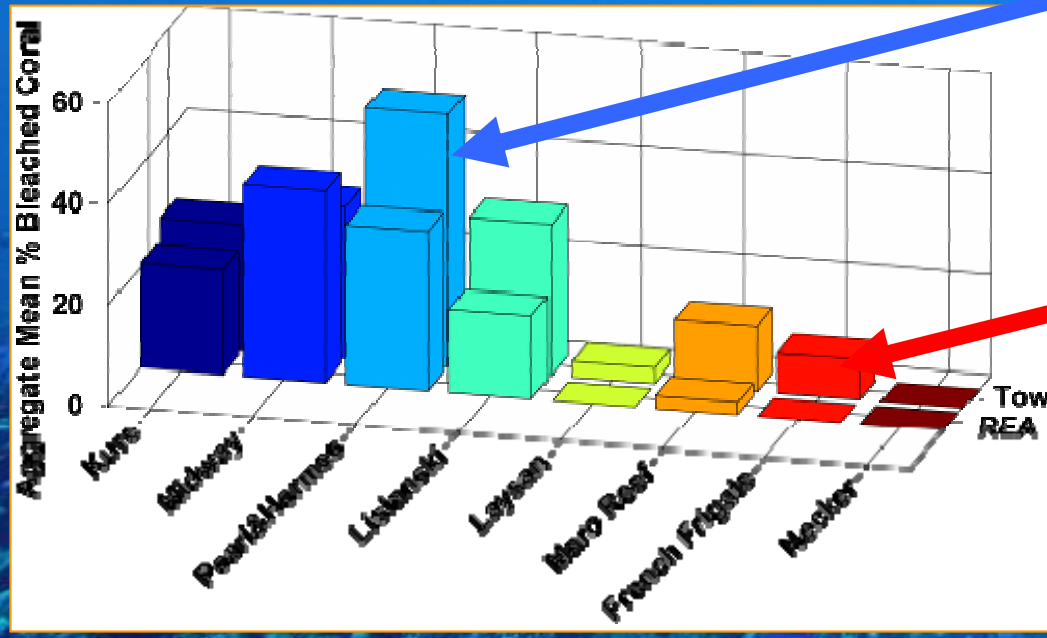
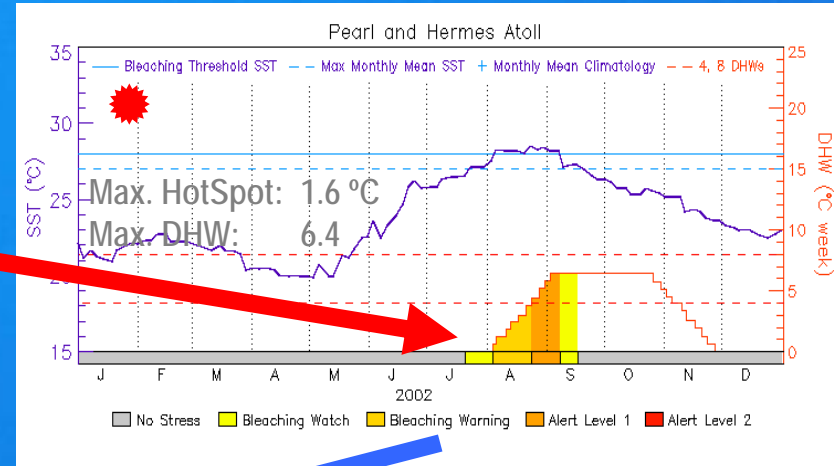
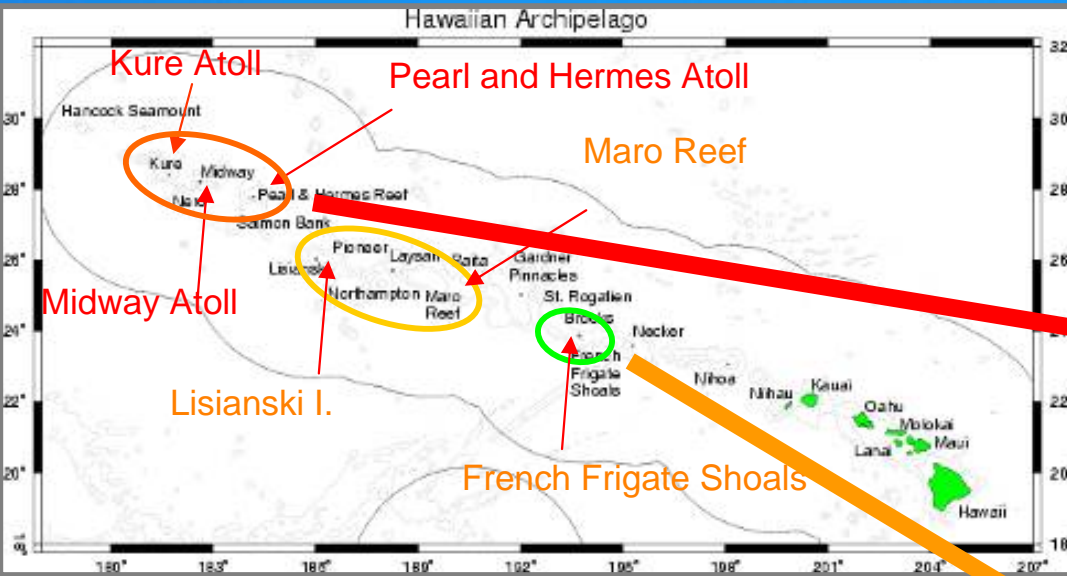
Management Requests:

-  Bleaching event prediction (AS, Guam) - **CRW**
-  Sea level rise (CNMI, Guam, HI) - **NOAA/UH**
-  Ecological forecasting for ocean acidification (HI) - **CRW**
-  Larval transport/recruitment (All) - **NOAA/UH**
-  Nearshore currents for LBSP (All) - **NOAA/USGS/UH**

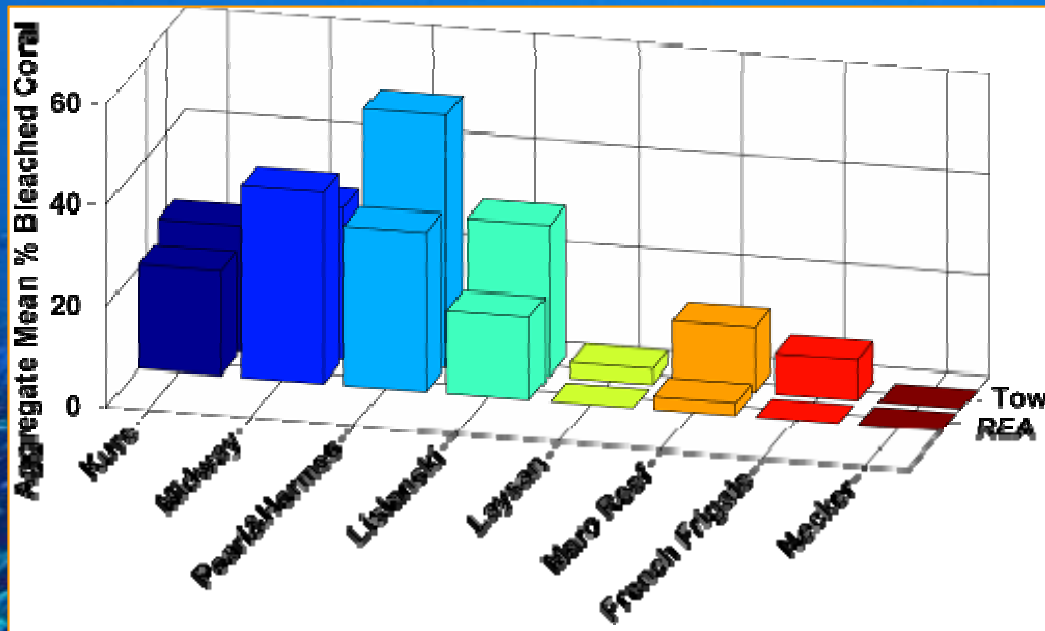
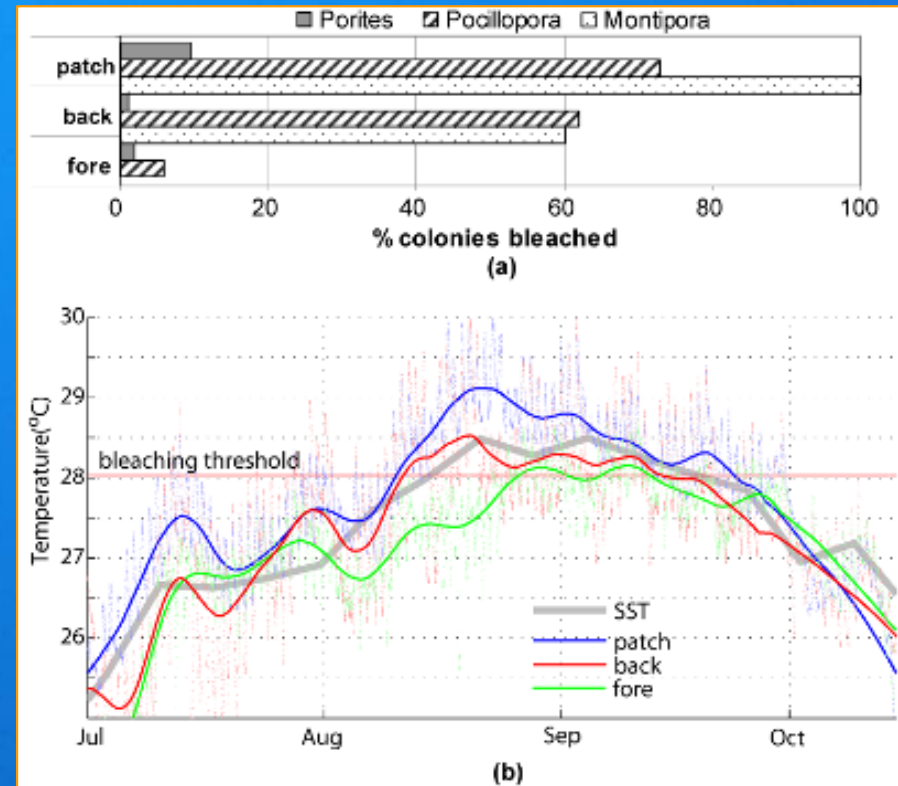
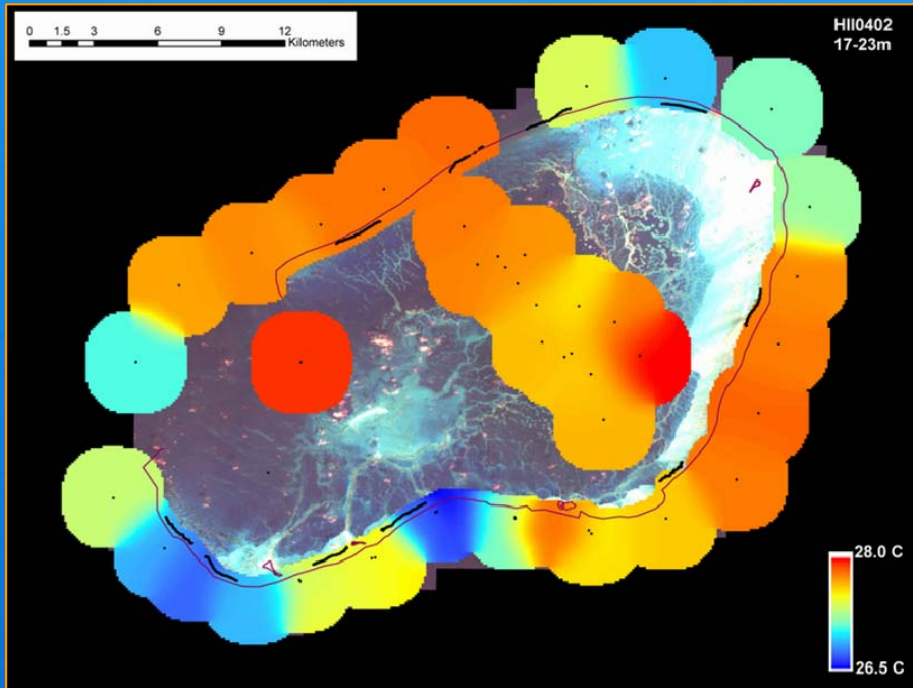
Real Applications



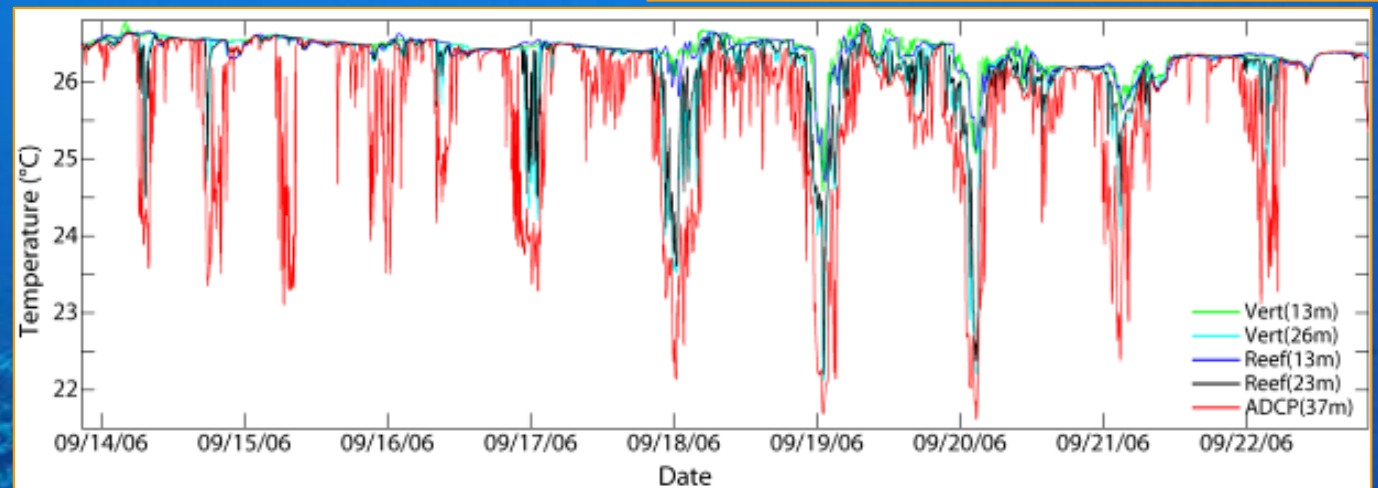
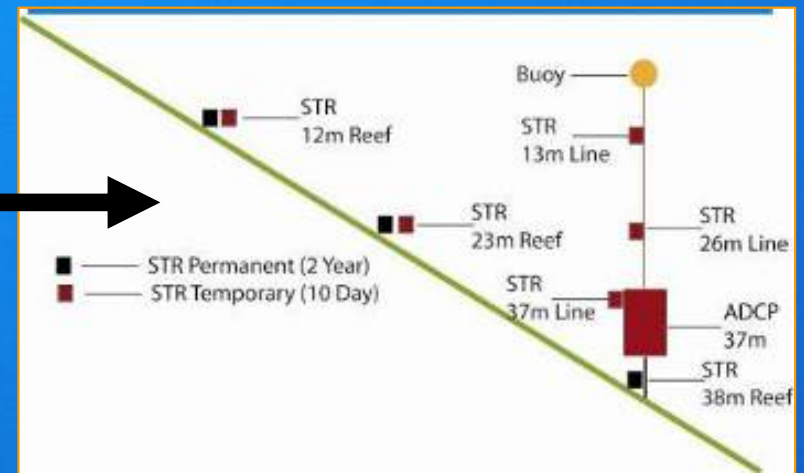
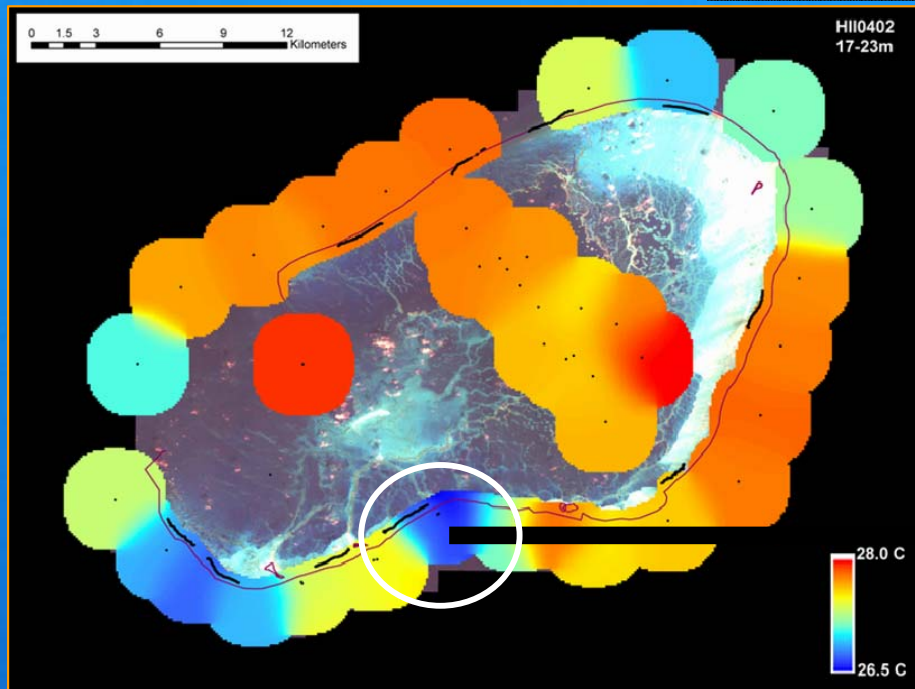
Case Study



Case Study









Real Applications









Challenges

-  Better integrate data within and across disciplines
-  Tailor information products to management needs
-  Improved access and more timely delivery
-  Provide automated observations where needed for management
-  Increase spatial (depth and area) and temporal resolution to answer management questions
-  Improve detection, modeling, and prediction of climate change impacts



Summary

Four Suites of Observations to Meet Management Needs:

-  Ship-based spatial oceanographic and water quality surveys
-  *In situ* instrumentation
-  Satellite observations
-  Modeling: Hydrodynamic and Ecological